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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,857	11/26/2003	Prathyusha K. Salla	132958XX-D/YOD GEMS:0264	9694

68174 7590 12/22/2009

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ART UNIT	PAPER NUMBER
3737	

MAIL DATE	DELIVERY MODE
12/22/2009	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte PRATHYUSHA K. SALLA, GOPAL B. AVINASH,
and CHERIK BULKES

Appeal 2009-005177
Application 10/723,857
Technology Center 3700

Decided: December 22, 2009

Before: LINDA E. HORNER, JOHN C. KERINS, and KEN B. BARRETT, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Prathyusha K. Salla et al. (Appellants) seek our review under 35 U.S.C. § 134 of the Examiner's decision rejecting claims 1-40. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

SUMMARY OF DECISION

We AFFIRM.

THE INVENTION

Appellants' claimed invention is a method for measuring the motion of one or more internal organs using one or more external sensors and/or using data acquired from a medical imaging system to determine the overall motion of at least one of the internal organs. Spec. 1:6-10. Claim 1, reproduced below, is representative of the subject matter on appeal.

> 1. A method for imaging an organ, comprising the steps of:
>
> acquiring a set of motion data for two or more organs from at least one of one or more types of electrical sensors and one or more types of non-electrical sensors;
>
> processing the set of motion data to extract two or more prospective gating points and two or more retrospective gating points for an organ of interest;
>
> acquiring a set of image data representative of the organ of interest using the two or more prospective gating points;
>
> processing a portion of the set of image data based upon the two or more retrospective gating points; and
>
> displaying or storing an image generated from the portion of the set of image data.

THE REJECTIONS

Appellants seek review of the Examiner's rejection of claims 1-40 under 35 U.S.C. § 102(b) as anticipated by Ronald H. Huesman et al., *Preliminary Studies of Cardiac Motion in Positron Emission Tomography,* Center for Functional Imaging, E.O. Lawrence Berkeley National Laboratory, University of California, March 29, 2001.

Appellants do not contest the Examiner's provisional rejection of claims 1-40 under the judicially-created doctrine of obviousness-type double patenting over claims 1-32 of copending Application 10/723,894, but rather assert that the rejection is not ripe for review on appeal. App. Br. 44. Our reviewing courts have sanctioned and reviewed provisional double patenting rejections based upon claims in a copending application. *See, e.g.*, *In re Longi*, 759 F.2d 887, 892 (Fed. Cir. 1985) (double patenting rejection over claims of three copending applications affirmed on the merits); *In re Mott*, 539 F.2d 1291, 1296 (CCPA 1976) (double patenting rejection under 37 C.F.R. § 101 over claims in a copending application was held correct on the merits but reversed because rejection was made final rather than provisional); *In re Wetterau*, 356 F.2d 556, 558 (CCPA 1966) (affirming provisional double patenting rejection over claims in a copending application on the merits). Thus, the issue is ripe and, because Appellants have failed to present any argument rebutting the merits of the Examiner's rejection, we summarily sustain this rejection.

ISSUES

Appellants contend the Examiner erred in the rejection of claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39 as anticipated by Huesman, because Huesman acquires data continuously, and does not extract and use prospective and retrospective gating points as claimed. App. Br. 46-63.

Appellants further argue the Examiner erred in the rejection of claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40 because the claims contain means-plus-function limitations, and the rejection does not analyze the structure recited in the Specification for performing the various claimed functions as is required for a prima facie case of unpatentability. App. Br. 61-62.

The issues before us are:

Have Appellants shown the Examiner erred in finding that Huesman extracts and uses prospective and retrospective gating points as claimed?

Have Appellants shown that the Examiner erred in the rejection of claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40, because the Examiner failed to make the appropriate findings as to how Huesman discloses the same or equivalent structure as the structure recited in the Specification for performing the various claimed functions?

FINDINGS OF FACT

We find that the following enumerated facts are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. Appellants' Specification describes prospective gating as a data gating technique to acquire image data of the motion of the organ being imaged, and retrospective gating as a data gating technique to select acquired image data of the motion of the organ being imaged. Spec. 8:4-10.
2. The term "retrospective" is commonly understood to mean "looking to or directed backward." WEBSTER'S NEW UNIVERSAL UNABRIDGED DICTIONARY (Deluxe 2d ed. 1983) ("retrospective," adjective, definition 2).

3. Huesman discloses methods for improved quantitative cardiac positron emission tomography (PET) that improve imaging by compensating for the respiratory motion of the heart. Huesman at 1. Huesman's method is based in part on the hypothesis that the motion of the heart is comprised of two independent components: respiratory motion, which changes the position and orientation of the heart; and contractile cardiac motion, which changes the heart's shape. Huesman at 1-2.

4. Huesman discloses use of preliminary studies in a dog and a man "to demonstrate the magnitude of cardiac wall motion and the feasibility of compensation during peak inspiration and near maximum expiration." Huesman at 3 (Canine Feasibility Study at Section 2, Human Feasibility Study at Section 3). For the canine study, an anesthetized dog was held at peak inspiration and maximum expiration while image data was gathered without gates for the cardiac cycle for eight seconds. Huesman at 3-4. Images from each respiratory phase were summed without registration (alignment), creating blurred images (figure 2A). Huesman at 4. Images from each respiratory phase were also registered before being summed, creating an improved image (figure 2B). Huesman at 4. For the human study, a subject held its breath at peak inspiration and near maximum expiration during acquisition of image data consisting of 26 short axis slices and 7 cardiac gates. Huesman at 4. From the image data, an image corresponding to the first cardiac gate taken at peak inspiration (figure 3A), was registered by translating the image 25 mm to align with an image

selected from the image data corresponding to the first cardiac gate at near maximum expiration (figure 3B) to produce an improved image (figure 3C). Huesman at 4-5. The canine and human feasibility studies provided evidence that substantial resolution improvement in cardiac imaging can be achieved through use of respiratory gating to acquire data and then appropriately recombining the cardiac images. Huesman at 5.

5. Building upon these feasibility studies, Huesman discloses a method using a doubly-gated strategy. Huesman at 2, 6. Huesman describes gating as acquiring PET data "for a sequence of time intervals within the cardiac cycle," adding that "cardiac gating was applied *prospectively*." Huesman at 2 (emphasis added).

6. Huesman describes modifying the software and hardware for a tomograph (a CTI/Siemens ECAT EXACT HR) "to support *prospective* cardiac and respiratory gating." Huesman at 5 (emphasis added). Further, Huesman discloses "[the] basic strategy for motion correction is to *acquire* PET data which are gated with respect to both cardiac and respiratory cycles" (emphasis added). Huesman at 8.

7. Huesman discloses the modified tomograph acquires image data (47 two-dimensional image slices) based on "binary inputs which encode a desired acquisition gate," and then stores the recorded event in one of up to 16 different buffers. Huesman at 5. Huesman further describes that the binary inputs used to determine the acquisition gates are a cardiac input and a respiratory input. Huesman at 5-6. The cardiac input signal is based on the time

since the last R-wave provided by a standard EKG monitor. Huesman at 6. The respiratory signal is based on the absolute amplitude of an analog signal from a pressure transducer connected to the patient's chest. Huesman at 6. A National Instruments NB-MIO-16 data acquisition board controlled by the LabVIEW® real-time environment in a Macintosh workstation receives the two signals (cardiac and respiratory), selects an out gating state from a 2D lookup table, and supplies the scanner with a suitable gate address (window to acquire image slices). Huesman at 6. The 2D lookup table uses three phases of the cardiac cycle (A- end diastole, B - mid diastole/systole, and C - end systole) and five phases of the respiratory cycle (numbered I-V) which define 15 suitable gate addresses. See Huesman at 6; see also *Cardiac State vs. Respiratory State* table of Figure 5. "The net result of the gated acquisitions is a 2D array of reconstructed image volumes." Huesman at 6.

8. Huesman discloses a Canine PET Emission Study "indicating the feasibility of doubly-gated acquisitions." Huesman at 7.
9. In the Canine PET Emission Study, two respiratory gates and six cardiac gates were used to acquire images during two thirty-minute periods. Huesman at 7. After the images were acquired, the images were selected and displayed for end diastole/end expiration, end diastole/end inspiration, and end systole/end expiration. Huesman at 7; Fig. 7A-C.
10. Appellants admit that Huesman discloses retrospectively removing respiratory motion from a set of previously-acquired image data

using peak inspiration and near maximum expiration to align and display the images. App. Br. 50-51.

11. Appellants admit that Huesman uses the term gate to describe a marker used to classify the acquired image in order to provide information corresponding to the phase of motion of the imaged organ (e.g. heart) at the time the data was acquired. App. Br. 53.

PRINCIPLES OF LAW

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987).

Appellants have the burden on appeal to the Board to demonstrate error in the Examiner's position. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)).

ANALYSIS

Claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39

Claim Construction

Independent claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39 each include the use of two or more prospective gating points and the use of two or more retrospective gating points. For each of these claims, the prospective gating points are used for acquiring a set of image data, and the retrospective gating points are used to select a portion of the set of image data. The gating points are prospective and retrospective relative to the point at which acquisition of the set of image data occurs. Appellants' Specification is consistent with this interpretation by describing that prospective gating points acquire data while retrospective gating points select a portion of the set of acquired image data (Fact 1). This interpretation is also consistent with the commonly understood meaning of retrospective, which is "looking to or directed backwards," so that, relative to the acquisition of the data, the retrospective gating point selects from data previously acquired (Fact 2). A person of ordinary skill in the art would interpret independent claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39 to require use of two or more prospective gating points to acquire a set of image data, and use of two or more retrospective gating points to select for processing a portion of the image data set acquired.

Huesman

Huesman discloses that respiratory motion is a known problem in cardiac imaging and describes methods to improve imaging by compensating for respiratory motion based on the hypothesis that respiratory motion changes the position and orientation of the heart (Fact 3). Huesman's preliminary studies on a canine and a human demonstrated that cardiac motion caused by respiration could be compensated for by translating cardiac images so that the images align (registration), resulting in an improved image (Fact 4).

Having proved the hypothesis on respiratory motion, Huesman discloses use of a doubly-gated strategy to acquire image data (Fact 5). Double gating refers to the use of a combination of a cardiac signal and a respiratory signal to define 15 suitable gate addresses in a two-dimensional look-up table (Facts 6-7). A Macintosh workstation receives the cardiac and respiratory signals, uses the signals to select an output gating state from the two-dimensional look-up table, and outputs a binary code to the scanner defining a desired acquisition gate for image data (Fact 7). Thus, the 15 suitable gate addresses from the two-dimensional lookup table represent two or more prospective gating points as claimed because the 15 suitable gate addresses are used to acquire image data.

In addition to the embodiment with 15 suitable gates, Huesman also discloses embodiments using the doubly-gated strategy for a canine study (two respiratory gates and six cardiac gates) (Facts 8, 9).

Huesman discloses that after the image data is acquired, the images are directed to buffers corresponding to the two-dimensional look-up table (Fact 8). The 15 criteria that define suitable gating points also define where that data is stored, so that the result is a two-dimensional array of reconstructed image volumes (Fact 7). Images are selected from the acquired image data based upon cardiac gating points at specific respiratory cycle points (Fact 9). Thus, Huesman discloses the use of two or more retrospective gating points because the points select images from the acquired images for display.

Further, Appellants have largely admitted that Huesman discloses use of two or more retrospective gating points (markers) because the points (e.g.

peak inspiration and near maximum expiration) are used to select images from the acquired images for display (Facts 10, 11).

Appellants' contention that Huesman acquires image data continuously is directly contradicted by Huesman's disclosure of a doubly-gated strategy that acquires image data "for a sequence of time intervals" (Fact 5). See App. Br. 47-54. We address some of the underlying contentions of Appellants' argument in further detail.

Appellants contend that in Huesman's Canine Feasibility Study, image data is acquired continuously for eight seconds, demonstrating that Huesman's method acquires data in a continuous rather than in a gated manner as claimed. See App. Br. 53 (referring to Huesman at 3). Appellants also submit that pages 3-5 of Huesman's method disclose a method of image registration which removes respiratory motion retrospectively rather than as claimed. App. Br. 50. In each contention, Appellants are referring to portions of the Huesman reference regarding preliminary studies performed to demonstrate the feasibility of registering images before performing gated studies (Fact 4). These arguments are unpersuasive because it is Huesman's doubly-gated strategy, discussed *supra*, that is the basis of this rejection (Facts 5-9).

Appellants contend that Huesman is continuously acquiring images, rather than prospectively acquiring image data, because Huesman discloses that ungated datasets could be synthesized by summing the gated data. App. Br. 53. This argument is premised on the interpretation that the claim would prohibit acquiring image data using gates that are sequential in time. The claim contains no such prohibition. As the Examiner points out, nothing in the claims would "exclude the acquisition of gated data sets that are capable of being summed to provide a continuous and uninterrupted stream of data." Ans. 6. In other words, the claims would not prohibit the ending time for acquiring data from the first gate to also be the starting time for acquiring data for the second gate and so on, so that summing the data from such time-sequential gates could produce a continuous stream of image data.

Appellants assert that the cardiac and respiratory graphs of figure 5 of Huesman demonstrate that the cardiac and respiratory data is used to subsequently classify data that is collected continuously. App. Br. 50, 56-57. We disagree. As explained regarding the operation of Huesman, *supra*, the cardiac and respiratory signals define 15 suitable gate addresses which are used to acquire image data (Facts 5-7). Perhaps the confusion regarding this portion of the reference is due to the fact that some of those same 15 suitable gate addresses that serve as prospective gating points also serve as two or more retrospective gating points because the points are used to select images from the acquired images for display (Facts 9, 10). Nothing in the claims prohibits a gating point from serving both as a prospective gating point and a retrospective gating point.

Appellants contend that prospective gating requires the gating points to be extracted from a set of motion data for one or more organs in order to time the acquisition of data. App. Br. 55. Huesman discloses a two-dimensional lookup table that provides suitable gating points for acquiring data based on input from cardiac and respiratory signals (motion data from the heart and lungs, one or more organs) (Facts 5-7).

Appellants' argument and supporting contentions that Huesman acquires data continuously, and does not extract and use prospective and retrospective gating points as claimed have failed to persuade us of error by the Examiner in the rejection of claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39.

Claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40

Claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40 each contain one or more means-plus-function limitations under 35 U.S.C. § 112, paragraph 6. App. Br. 61. In particular, these claims call for means for processing sets of data. These claim elements are computer-implemented. Spec. 10:15-17 (computer 24). As means-plus-function claims, the claims "*shall* be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112, paragraph 6 (emphasis added). For computer-implemented means-plus-function claim elements, the corresponding structure is the algorithm disclosed in the specification for performing the recited function. *Aristocrat Techs. Austl. Pty Ltd. v Inter. Game Tech.,* 521 F.3d 1328, 1333 (Fed. Cir. 2008).

We agree with Appellants that a proper rejection of a claim containing means-plus-function limitations under 35 U.S.C. § 112, paragraph 6, must include an analysis of the structure recited in the specification for performing the various claimed functions as it relates to the structure or equivalent in the prior art. *See In re Donaldson*, 16 F3d. 1189, 1194-1195 (Fed. Cir. 1994) ("Per our holding, the 'broadest reasonable interpretation' that an examiner may give means-plus-function language is that statutorily mandated in paragraph six. Accordingly, the PTO may not disregard the structure disclosed in the specification corresponding to such language when rendering a patentability determination.")

Here the rejection acknowledges the claims contain means-plus-function language, but states only that "all means and steps recited in these claims are anticipated by the Huesman (2001) reference as discussed above," and that "the descriptions of means for processing data, acquiring data, reconstructing data, and processing reconstructed data present in the specification are very broad." Ans. 3, 7. This falls short of an analysis of the structure recited in the Specification for performing the various claimed functions as it relates to the structure or its equivalent in the prior art. In particular, we note no corresponding algorithms are mentioned in the rejection. We have no factual findings to review on this point, and thus we cannot sustain the rejection of claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40.

CONCLUSIONS

Appellants have not shown the Examiner erred in finding that Huesman extracts and uses prospective and retrospective gating points as claimed.

Appellants have shown the Examiner erred in the rejection of claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40, because the Examiner failed to make the appropriate findings as to how Huesman discloses the same or equivalent structure as the structure recited in the Specification for performing the various claimed functions.

The provisional rejection of claims 1-40 under the judicially-created doctrine of obviousness-type double patenting is sustained.

DECISION

We AFFIRM the decision of the Examiner to reject claims 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, and 37-39 under § 102(b) and the decision of the Examiner to reject claims 1-40 under the judicially-created doctrine of obviousness-type double patenting.

We REVERSE the decision of the Examiner to reject claims 4, 8, 12, 16, 20, 24, 28, 32, 36, and 40 under § 102(b).

AFFIRMED

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